(12) UK Patent Application (19) GB (11) 2 274 103 (13) A

(43) Date of A Publication 13.07.1994

(21) Application No 9300341.6

(22) Date of Filing 09.01.1993

(51) INT CL[5]
C02F 3/02 1/52 1/74

(52) UK CL (Edition M)
C1C CJB C217 C230 C311 C40Y C400 C416 C43Y C431 C432 C441 C633

(56) Documents Cited
GB 2039873 A US 4603000 A

(58) Field of Search
UK CL (Edition M) C1C
INT CL[5] C02F
ONLINE DATABASE: WPI

(71) Applicant(s)
John Anthony Casey
Apartment 2208, 440 Davis Court, San Francisco, California CA 94111, United States of America

Reynaldo Ongoco Navarro
43 Fordham Street, White Plains, Quezon City, Philippines

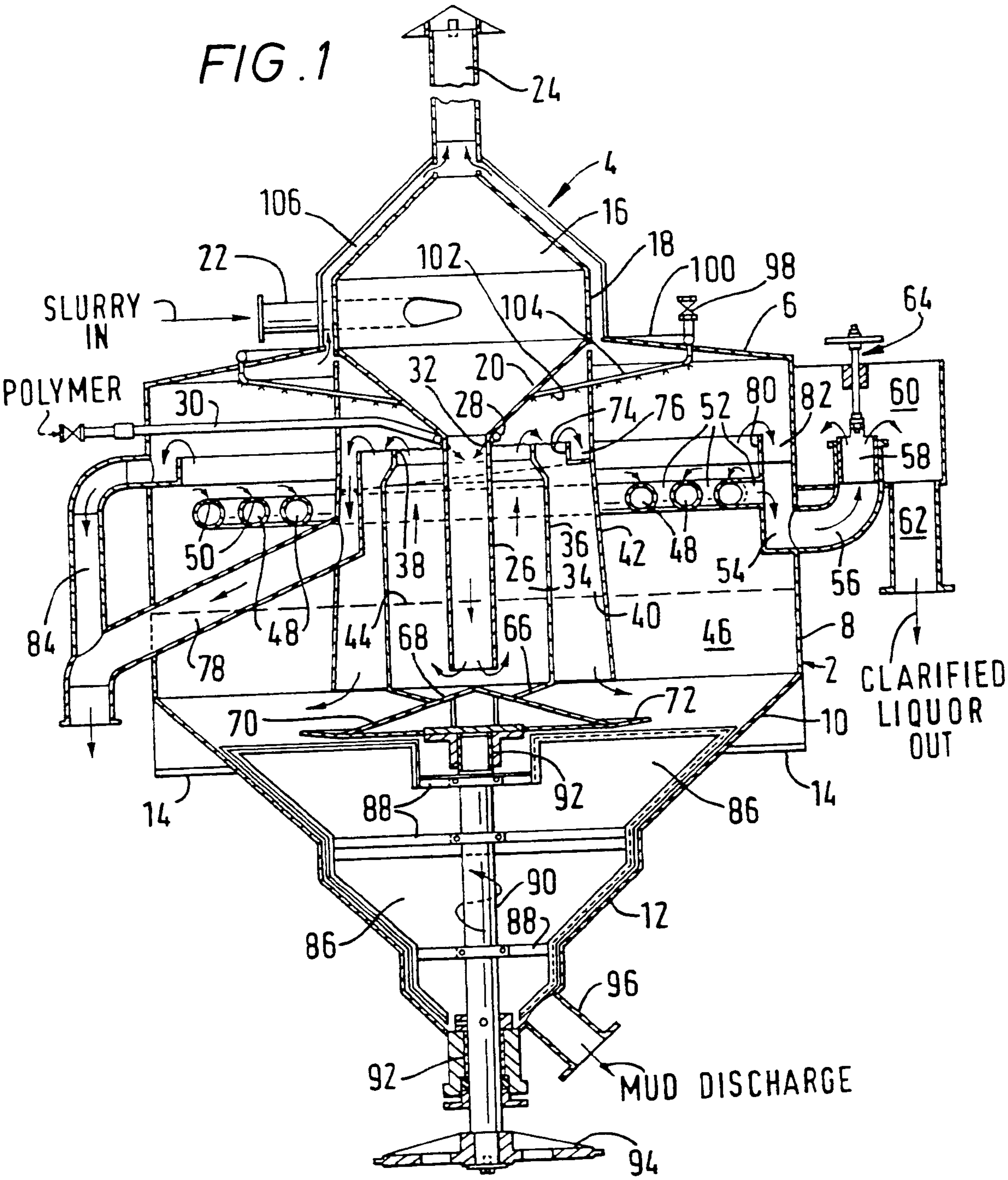
(72) Inventor(s)
John Anthony Casey
Reynaldo Ongoco Navarro

(74) Agent and/or Address for Service
Stevens, Hewlett & Perkins
1 St Augustine's Place, BRISTOL, BS1 4UD, United Kingdom

(54) A process of treating waste water

(57) Waste water containing organic waste material is treated by a process comprising introducing the waste water into a treatment tank, subjecting the water in the tank to aeration, allowing the organic waste material to undergo aerobic digestion and/or oxidation and then clarifying the resulting slurry containing solid particles of matter. The slurry is clarified by subjecting it to treatment in a preflocculation zone with one or more flocculating agents to coagulate the solid particles as flocs and imparting to the flocs as they are forming in the slurry a rolling action which results in the production of a heavily coagulated slurry containing substantially uniform, large, dense flocs of coagulated matter. The coagulated slurry is then introduced into a clarifier tank under conditions of laminar flow while avoiding disruption or breakage of the flocs. The dense flocs then settle to the bottom of the tank leaving a clarified liquor.

FIG.1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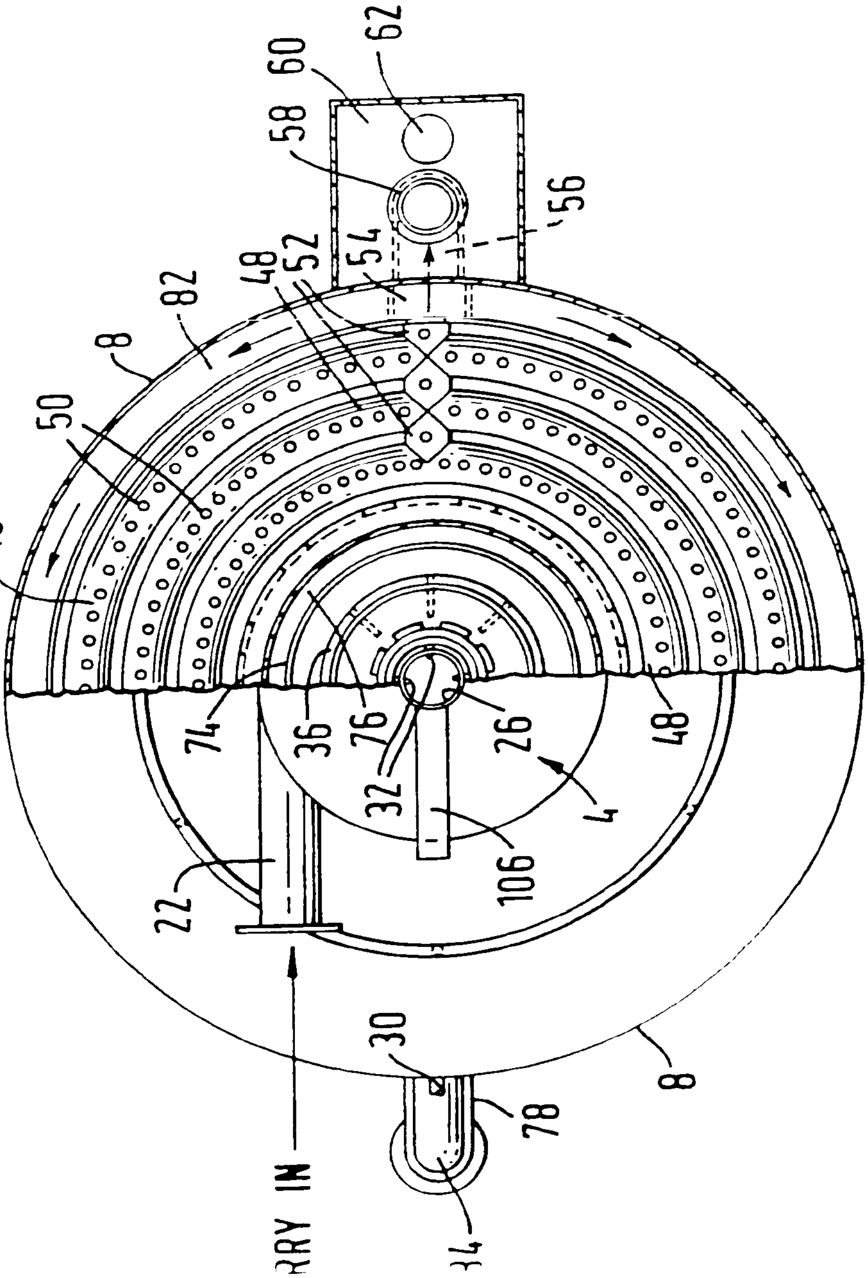

FIG. 2

A PROCESS OF TREATING WASTE WATER

The present invention relates to a process of treating waste water.

It is well known that the disposal of untreated waste waters containing organic matter can cause damage to the environment. If such wastes are fed, untreated, into waterways or into the sea the organic matter therein causes a depletion of the oxygen level in the water. If such disposal is allowed to continue, this depletion of the oxygen level can ultimately cause the death of the normal inhabitants of those waters into which the wastes are fed.

Traditionally, waste waters are treated to reduce their biological oxygen demand (BOD) and their chemical oxygen demand (COD) by aerobic digestion and/or anaerobic digestion. Anaerobic treatments, carried out in the absence of oxygen, are useful particularly for larger projects. Aerobic treatments are frequently used for smaller waste water projects where flow rates may be up to a few million gallons per day and where pollution levels are perhaps up to 3,000 to 4,000 units as ppm BOD.

There are many variables in designing conventional plants for such aerobic treatment and these all have to be taken into consideration in order to achieve an effective way of introducing air or oxygen into water to aid the digestion or oxidation of the organic pollutants. Air may be introduced under pressure into the water to be treated by aerators and many designs and sizes of such aerators are used. Lagoons to contain the water vary in size, shape and configuration. Technology is used to develop natural microflora present in the waste water to form an activated sludge which accelerates digestion of polluting organics.

Following aeration, the treated water is conventionally taken to a clarifying basin and allowed to settle with or without the help of clarifying aids. Settling in these basins typically takes from 6 to 48 hours. Following settling, the underflow sludge is typically taken for dewatering and the overflow clear "water" is taken either for further treatment, filtration, etc. or is sufficiently free of pollutants to be discharged to a river or sometimes chlorinated and recycled for further use.

Waste water treatment programs are most often designed individually for clients by local specialised consultants. The characterisation of the waste water and the requirements for effluent water quality, plus space available and acceptable purchase and operating costs are major factors in designing individual plants.

Activated sludge characteristics typically entail serious difficulties for both effective settling, separation, and thereafter, further dewatering when required. The activated sludge is composed principally of microbes occurring naturally in the waste water and these are somewhat unpredictable and vary from time to time. Nutrient chemicals containing nitrogen and phosphorous are customarily added to facilitate growth of the micro organisms. Control of all the variables is complex and plants are frequently designed well oversize in order to tolerate these variables, and to be able to deal with the occasional surges in the level of pollution in the waste water itself and still achieve

water containing organic waste material according to a process which combines a series of specific process

steps many advantages compared to conventional aeration treatments can be obtained.

The present invention provides a process for treating waste water containing organic waste material which process comprises introducing the waste water to be treated into a treatment tank, subjecting the water to aeration, allowing the organic waste material to undergo aerobic digestion and/or oxidation and clarifying the resulting slurry containing solid particles of matter wherein the slurry is clarified by subjecting it to treatment in a preflocculation zone with one or more flocculating agents to coagulate the solid particles as flocs, imparting to the flocs as they are forming in the slurry a rolling action thereby resulting in a heavily coagulated slurry containing substantially uniform, large, dense flocs of coagulated matter, introducing the coagulated slurry into a clarifier tank under conditions of laminar flow while avoiding any substantial disruption or breakage of the flocs whereby the dense flocs settle to the bottom of the tank thus leaving a clarified liquor.

The treatment tank may be an aeration basin of any of the conventionally-used designs. These, are rarely more than 2 metres deep. Preferably, however, the treatment tank has a depth greater than 2 metres and more preferably a depth of from 2 to 4 metres. The use of such a deep treatment tank makes it possible to benefit from the use of a small surface area, which is important where space is restricted. An especially preferred treatment tank according to the present invention has two parallel side walls and two end walls which are substantially semicircular in section since the contents of such a tank can be made to circulate around the tank to ensure that all waters

are kept in motion. This provides an excellent environment for microflora growth and allows intimate contact between the microflora and the organic waste material which provides food for the microflora.

Aeration of the waste water to be treated is achieved by the mechanical injection of air into the water. Preferably, the waste water is aerated by injecting air under pressure into the water by means of one or more, typically from 2 to 14, directional air guns or lances since the mechanical injection of air creates turbulence in the waste water thus improving the contact of air with the microflora and the organic waste material. The use of directional air guns makes it possible to cause the waters to circulate around and into the depths of the treatment tank so that no parts of the water remain immobile. We have found that particularly good results may be achieved by locating the air guns at an angle of from 30° to 75° to the horizontal. By using air guns pointing downwards at an angle of about 65°, aerobic conditions can be sustained in a tank down to a depth of 4 m.

Air guns (also known as 'aeration guns') allow air to be injected under pressure beneath the surface of the waste waters. These introduce air into the water through a hollow tube typically constructed around the shaft of a propeller. The use of air guns allows about 20% more oxygen to be dissolved per 1 hp (horse power) used compared to conventional circular and/or surface aerators. The air guns are typically installed, according to the present invention, such

preferred embodiments of the invention in respect of the shape of the treatment tank and the number and

positioning of the air guns, the waters in the treatment tank are maintained in constant circulation and turbulence thus avoiding quiescent or dead spots in the tank where anaerobic conditions can develop.

According to a preferred embodiment, the organic waste material in the waste water is allowed to undergo aerobic digestion and/or oxidation in the presence of a bacterial and/or fungal supplement. This is achieved by introducing such a supplement to the waste water before or during the digestion stage, typically before or during the aeration treatment, to augment the action of the naturally occurring microflora in the water. Bacterial and fungal supplements useful according to the present invention are available as proprietary formulas. Such a supplement, we have found, forms a bio-augmented sludge that flourishes very well in well mixed, aerated, circulating waste waters.

Typically, a supplement of microflora and/or fungi is added to the treatment tank at an initial dosage of from 100 to 500 lbs per ton of BOD. Periodically, further doses of supplement may be added to sustain the balance of microflora and/or fungi in the treatment tank to ensure a reliable, predictable behaviour of the bio-augmented waste waters such that effective processing can be sustained. The amount of supplement required may be determined by monitoring the percentage of sludge in the treatment tank waters. We find that if a sample, after a 30 minute settling period, contains less than 10% sludge the addition of supplement to the treatment tank waters needs to be increased. If a sample contains over 20% sludge then the addition of supplement needs to be distinctly reduced. In this way, we have found that the supplement dosage may vary from 0 to 100 lbs per ton

of BOD per day added weekly. Nutrients, such as nitrogen- and phosphorus- containing materials, for the microflora/fungi are preferably added to the treatment tank waters as is generally known in the art. The amounts of nutrient chemicals required to support augmented microflora growth are typically half or less than calculated normally.

The supplement microflora and/or fungi, may be prepared by growing them in broths obtained from natural. individual tropical plants and residues. When grown in an aerobic, turbulent condition the bio-augmented sludge can achieve rates of BOD reduction of from 20% to 100%, typically about 50%, faster than can be achieved by the naturally present microflora on its own. Furthermore, the sludge has a quasi gelatinous nature which, when taken into a quiescent zone, settles faster and more predictably than normal activated sludge which has not been bio-augmented without the need to use supplementary clarification aids.

Underflow microflora sludge may be collected in a sidestream settling basin. The sludge may be pumped from the settling basin back to the treatment tank such that an average residence time for microflora activated sludge will typically be within the range of from 4 to 10 days.

The waste water containing organic waste materials is preferably separated from any grit or other non-digestible solid particulate material at a stage prior to treatment. Oil may also be removed in a preliminary treatment. The aeration and digestion

usually for 1 day before treated water is subjected to a clarification treatment.

The treated water submitted to the clarification treatment will be in the form of an aqueous slurry of solid particles. It is essential in the process of the present invention that the clarification includes, as an essential step, the step of subjecting the slurry to a treatment in a preflocculation zone with one or more flocculating agents to bring about the coagulation of the solid particles as flocs. The preflocculation is preferably carried out under conditions such that the slurry is in a homogeneous state when it comes into contact with the one or more flocculating agents. Such an homogeneous state may be achieved by subjecting the aqueous slurry to turbulent flow before the one or more flocculating agents are introduced therein. This ensures that a thorough mixing of the slurry with the flocculating agents occurs to ensure a quick and effective coagulation of the solid particles in the slurry. It is critical, however, that the flocs are not subjected to conditions which would result in their being broken or disrupted and, for this reason, any turbulent flow in the slurry should not persist once the one or more flocculating agents are introduced. For this reason, it is preferred that the slurry flows under laminar conditions once the flocculating agent(s) have been added. After the addition of the one or more flocculating agents, the slurry, which is preferably flowing through the preflocculation zone under conditions of laminar flow, is subjected to a change in direction such that a rolling action is imparted to the flocs of solid material being formed in the slurry. This rolling over action, or recirculation, in the preflocculation chamber serves to create relatively large, uniformly-sized, substantially spherical flocs which are

relatively dense and also serves to sweep any uncoagulated particles onto the larger coagulates.

The one or more flocculating agents employed in the process of the present invention may be chosen from conventionally used flocculating agents. These are generally inorganic or organic polymeric materials. According to a preferred embodiment of the invention, an inorganic coagulant or flocculating agent is added to the slurry and then an organic polymeric flocculating agent is added to the slurry. Examples of suitable inorganic flocculating agents include aluminium sulphate and ferric chloride. Typically, the inorganic flocculating agent is added in an amount in the range of from 20 to 200 ppm. The preferred amount depends on sludge characteristics but is generally from 80 to 100 ppm. A typical organic polymeric flocculating agent is a high molecular weight polyacrylamide although other polymeric substances suitable for use as flocculating agents are known in the art. The organic polymeric flocculating agent will usually be added in an amount of from 0.5 to 2 ppm, preferably about 1 ppm. The flocculating agents are added to the slurry in the form of dilute aqueous solutions and where both an inorganic and an organic polymeric flocculating agent is used, the inorganic agent will be added to the slurry first.

The action of the coagulant and/or flocculating agents and the rolling over action of the flocs in the slurry result in the formation of flocs which are relatively large and uniform and having a shape which is approximately spherical. The flocs

produced by subjecting sludge particles to coagulation/flocculation in a conventional manner.

Following the preflocculation treatment, the well coagulated slurry is introduced under laminar flow into a clarifier tank without subjecting the flocs therein to any substantial disruption or breakage. According to a preferred embodiment the coagulated slurry is discharged downwards into a clarifier tank through an annular ring which allows the relatively dense coagulates to continue their downward movement while the clear liquid disperses throughout the clarifier tank in an uniform laminar manner. The flocs are thus allowed to settle at the bottom of the clarifier tank leaving the clarified liquor at the top of the tank ready to be drawn off. The clarified liquid may be removed from an upper portion of the clarifier tank while settled solids in the sediment bed ("underflow sludge") may be removed from the bottom of the clarifier tank.

The preflocculation and clarification treatments described above are, in a specially preferred embodiment of the present invention, carried out in an apparatus of the type disclosed in US patent No 4,603,000. An apparatus according to this US patent is shown in the attached drawings, wherein

Figure 1 is a vertical cross sectional view through the apparatus; and

Figure 2 is a top view thereof, the left hand portion being shown in plan and the right hand portion being shown in horizontal cross section.

An apparatus useful for carrying out the present invention and illustrating the process of the present invention is shown in Figures 1 and 2. The apparatus includes a clarifier tank 2 and a preflocculating vessel 4 extending coaxially centrally into tank 2 through a top 6 thereof. Tank 2 includes a cylindrical main portion 8 and a bottom portion

defined by successive downwardly converging conical portions 10, 12. The clarifier tank 2 is adapted to be mounted in a conventional manner, for example by support brackets 14.

The preflocculating vessel includes an upper chamber 16 defined by a cylindrical member 18 and a downwardly converging conical member 20. An inlet pipe 22 opens tangentially into upper chamber 16 for the supply thereto of a solid-liquid slurry obtained following the aeration and digestion stages in the process. Supplying the slurry tangentially into chamber 16 causes it to flow turbulently therein, for example by whirling as it cascades.

Extending from a bottom opening in conical member 20 is a vertical pipe 26. As the slurry enters pipe 26 the turbulent flow of the slurry gradually changes to laminar flow. Positioned annularly around pipe 26, for example at the upper portion thereof as shown in Figure 1, is a conduit 28 connected to a supply line 30 for supply of a suitable flocculating agent, for example a polymer material, as will be understood by those skilled in the art. Conduit 28 has extending inwardly and downwardly through pipe 26 a plurality of nozzles 32 for directing the polymer into the slurry passing downwardly through pipe 26. This causes the solids of the slurry to coagulate as flocs.

The pipe 26 discharges through the bottom end thereof the slurry into the lower portion of a lower chamber 34 defined by an inner cylindrical member 36. The slurry passes from the bottom of pipe 26 into the

in the manner indicated by the arrows in Figure 1. During passage through chamber 34 the slurry thus

becomes preflocculated, and this preflocculated slurry overflows over the upper end 38 of cylindrical member 36 and passes downwardly through an annular passage 40 defined around member 36 by means of an outer cylindrical member 42 which has a downwardly diverging configuration and which has an open lower end. Thus, the preflocculated slurry is introduced directly into the clarifier tank 2. The coagulated solids settle downwardly on the bottom of the tank and form the mud bed.

At the upper portion of a clarified liquid zone above the mud bed 46 are provided a plurality of concentric annular toric-shaped clarified liquid collecting tubes 48. The tubes 48 have in upper portions thereof annularly spaced orifices or openings 50 for the passage therethrough into the interiors of tubes 48 of the clarified liquid. The tubes 48 are connected by a radial tube arrangement 52 which is connected to a clarified liquid collector 54 which is connected to a collecting elbow 56. The liquid flows through elements 54 and 56 and overflows through an upper end thereof or through an upper end of an adjusting sleeve 58 positioned therein and into a collecting chamber 60. Clarified liquid is discharged from chamber 60 through a discharge outlet 62. Sleeve 58 is vertically adjustable by means of an arrangement 64 whereby it is possible to adjust the vertical height of sleeve 58, thereby changing the upper level of the clarified liquid within the clarified liquid zone above the mud bed 46 in clarifier tank 2.

At the bottom of lower chamber 34 is provided an inwardly converging frusto-conical first surface 66 extending downwardly from the bottom of cylindrical member or body 36 and an inwardly converging conical second surface 68 extending upwardly from first

surface 66 toward but spaced from pipe 26. Thus, the slurry supplied downwardly through pipe 26 is deflected outwardly and upwardly into and through the lower chamber 34 by means of surfaces 66, 68. At this time, there is imparted a rolling action to the flocs of solid material being formed in the slurry. This achieves the very desirable feature of forming the flocs into a more dense structure, the flocs being more uniform in size than in previous arrangements.

In a similar manner, at the bottom of annular passage 40 there is provided an outwardly and downwardly diverging annular surface 70 having an upwardly flared annular outer edge portion 72. Thereby, the preflocculated slurry passing downwardly through the open lower end of annular passage 40 is deflected outwardly and somewhat upwardly into mud bed 46.

Additionally, at the top of lower chamber 34 there is provided an arrangement for removing debris from the preflocculated slurry. Thus, as the preflocculated slurry overflows over the upper edge 38 of inner annular member 36 and passes downwardly into the annular passage 40, debris floating on the preflocculated slurry overflows a weir 74 having a serrated upper edge and into an annular channel 76. The debris is collected in channel 76 and passes therefrom by gravity into a discharge pipe 78, for example to a screen whereat solid particles are separated.

During settling of flocculated solids into mud bed 46, the mud bed 46 is concentrated and compacted

[illegible] example [illegible] rpm. This slowly moving mud rake helps free solid particles from occluded

slurry and to compact the mud for ultimate discharge. Mud rake 86 may be of any conventional and known design. In the illustrated arrangement, mud rake 86 is in the form of vertical, radial members grazing the inner surfaces of the lower portion of the clarifier tank and supported by horizontal, radial arms 88 on a shaft 90 which is journaled, for example at bearings 92 and which is driven by a motor, for example via a gear 94.

The level of mud bed 46 within clarifier tank 2 is selectively controlled or adjusted in part by controlling the level of clarified slurry, but primarily by discharge of mud through an outlet 96, for example by a suitable positive displacement pump.

The apparatus includes suitable means for washing of the internal portions of the apparatus, for example a water supply 98 connected to a manifold pipe 100 having connected thereto wash water supply pipes 102 having therein wash water supply orifices 104. The operation of such structure to achieve washing of the apparatus will be understood by those skilled in the art.

Furthermore, the flocculating vessel 4 has therein vent passages 106 to enable flashing or ventilation of gases from the interior of the apparatus, which otherwise essentially is closed. Such flashing or venting will be apparent to those skilled in the art from a consideration of the various arrows indicative thereof and shown in Figure 1.

Typically, perforations may be provided through the plates forming surfaces 66 and 72, thereby allowing liquid beneath such surfaces to rise through the mud concentration zone of the clarifier tank and to percolate through such surfaces for prompt exit as clarified liquid.

In a preferred arrangement, a diluted polymer as a coagulating agent is added through pipes 30, 28 and nozzles 32 to the slurry. Such polymer may be a high molecular weight anionic polymer, as will be understood by those skilled in the art. According to a preferred embodiment an inorganic coagulating agent is added before the addition of the polymer. The first polymer application may be at nozzles 32 as discussed above. An inorganic agent application may be in chamber 34, for example at a lower or upper portion thereof. Such multiple applications could be sequentially cationic, anionic and cationic, or whatever sequence of application is most appropriate to preflocculate the slurry involved.

In accordance with the present invention, the preflocculated slurry is introduced into the mud bed 46 at a level substantially midway between the clarified slurry or liquid take off pipes 48 and the deflector surface 72.

In accordance with the present invention, the flocs of solids formed will be heavier and more stable than in prior arrangements. The slurry introduced at inlet 22 is typically conditioned with chemicals, etc. to have a pH of approximately 7.0, and preferably not exceeding 7.2. The rolling swirling motion imparted by surfaces 66, 68 is of importance because it allows the insoluble and colloidal particles to be coagulated and flocculated in conjunction with continuing addition of polymer, such that the flocs grow into uniformly sized particles of greater density than otherwise would be formed.

is typically within the range of from 15 to 40 minutes, with 30 minutes being average, both for

preflocculating and clarifying.

Example

Waste water, having a typical BOD of from 500 to 2000 mg/l, was treated in a conventional treatment plant. Thus, the waste water was subjected to aerobic digestion in the presence of activated sludge in a 2 metre deep pond. The microflora in the sludge are supplied with nutrients to aid growth.

Following digestion, the treated waste water is led into a clarifying basin to allow settlement of suspended solids. The average performance data of the conventional waste water treatment plant are shown below in Table 1A.

Table 1B shows the daily influent and effluent BOD values of the water in the conventional plant.

Table 1A

AVERAGE PERFORMANCE DATA OF CONVENTIONAL WASTE WATER TREATMENT PLANT

Plant Area Sq. Ft.	Sludge Disposal	Chemical Consumption per day	Energy kWh/day	Power hp Installed
40,000	Decanter	US$400.00	4,000	200

INFLUENT

Capacity Gallons (US)/day	BOD mg/l	Suspended Solids (ppm)	Color PCU
600,000	500 to 2000	250	150

EFFLUENT

Capacity Gallons (UK)/day	BOD mg/l	Suspended Solids (ppm)	Color PCU
600,000	40	75	50

Table 1B

INFLUENT		EFFLUENT	
DAY	BOD, mg/l	DAY	BOD, mg/l
1	1564	3	92
2	436	4	53
3	4286	5	110
4	373	6	40
5	1921	7	95
6	238	8	71
7	459	9	35
Ave.=	1325.29	Ave.=	70.86

Waste water having a BOD similar to that of the water treated in the conventional treatment plant above was treated according to the present invention. Thus, the water was aerated in a basin having a depth ranging from 2 to 4 metres using 10 air guns having a direction of 65°C down from the horizontal to create circulation around, and into the depths of, the pond. A mixture of bacteria and fungi was added to the water in the pond and their growth was supported by the addition thereto of a proprietary nutrient formulation. The waste water following aeration and

[illegible] and as described herein with reference to the accompanying Figures. The

flocculating agents used in the preflocculation treatment were aluminium sulphate and a high molecular weight polyacrylamide proprietory flocculating aid.

The average performance data of the treatment of the present invention are shown below in Table 2A. Table 2B shows the daily influent and effluent BOD values of the water in the treatment according to the invention.

Table 2A

AVERAGE PERFORMANCE DATA OF WASTE WATER TREATMENT PLANT PRESENT INVENTION

Plant Area Sq. Ft.	Sludge Disposal	Chemical Consumption per day	Energy kWh/day	Power hp Installed
23,000	Decanter	US$280.00	2,510	189

INFLUENT

Capacity Gallons (US)/day	BOD mg/l	Suspended Solids (ppm)	Color PCU
600,000	500 to 2000	250	150

EFFLUENT

Capacity Gallons (UK)/day	BOD mg/l	Suspended Solids (ppm)	Color PCU
600,000	26	50	35

Table 2B

INFLUENT DAY	BOD, mg/l	EFFLUENT DAY	BOD, mg/l	Variation from the Ave.	% BOD Reduction
1	2856	3	31	- 8.8	98.9
2	1349	4	38	+ 11.8	97.2
3	555	5	40	+ 15.0	92.8
4	3931	6	41	20.5	98.9
5	2737	7	39	14.7	98.6
6	118	8	35	2.9	70.3
7	425	9	39	14.7	90.8
9	347	11	34	0	90.2
11	947	13	22	- 35.2	97.7
13	5266	15	23	- 32.3	99.6
14	2172	16	38	11.8	98.2
15	1235	17	36	5.9	97.1
22	268	24	41	20.5	84.7
23	6071	25	36	5.9	99.4
25	366	27	32	5.9	91.2
27	583	29	28	17.6	95.2
28	603	30	33	2.9	94.5
29	768	31	27	20.5	96.5
Ave.=1699.83		Ave.=	34	Ave.= 94%	

In the Tables 1A and 2A the expression "Chemical Consumption per day" means the total cost per day of any chemical additives used, for example bacterial and/or fungal supplements, nutrients for the microflora, acids and coagulating/flocculating agents and the expression "suspended solids" refers to insoluble dirt in parts per million. The expression "Color PCU" refers to the color of the influent and

milligram of platinum per litre in the form of the chloroplatinate ion. The test procedure is as

follows. 1.246 g of potassium chloroplatinate and 1.0 g of crystalline cobaltous chloride are dissolved in distilled water with 100 ml of hydrochloric acid and diluted with distilled water to give 1000 ml. This forms the stock solution (reference) which is equivalent to 500 PCU color. This may be diluted further to obtain reference solutions having lower color units. The PCU color of the influent and effluent materials may be determined by direct visual comparison of a sample with the reference solution(s) or by comparing the absorbances of a sample and a reference solution, as determined spectrophotometrically.

It can be seen, by comparing the data in Table 2A with those in Table 1A and by comparing the BOD values in Table 2B with those in Table 1B that the treatment according to the present invention gives rise to certain advantages compared to the conventional treatment. These include:

1 Reduction in plant area required.

2 Reduction in power required.

3 Lower operating costs.

4 Lower capital costs for plant, etc.

5 Greater efficiency and more consistent performance achieved.

6 Greater tolerance of effluent variance.

Claims

1 A process for treating waste water containing organic waste material which process comprises introducing the waste water to be treated into a treatment tank, subjecting the water to aeration, allowing the organic waste material to undergo aerobic digestion and/or oxidation and clarifying the resulting slurry containing solid particles of matter wherein the slurry is clarified by subjecting it to treatment in a preflocculation zone with one or more flocculating agents to coagulate the solid particles as flocs, imparting to the flocs as they are forming in the slurry a rolling action thereby resulting in a heavily coagulated slurry containing substantially uniform, large, dense flocs of coagulated matter, introducing the coagulated slurry into a clarifier tank under conditions of laminar flow while avoiding any substantial disruption or breakage of the flocs whereby the dense flocs settle to the bottom of the tank thus leaving a clarified liquor.

2 A process according to claim 1, wherein the slurry is first treated with an inorganic flocculating agent and then with an organic polymeric flocculating agent. 3A process according to claim 2, wherein the inorganic flocculating agent is selected from aluminium sulphate and ferric chloride.

4 A process according to claim 2 or claim 3, wherein the organic polymeric flocculating agent is a high molecular weight polyacrylamide.

5 A process according to any one of claims 1 to

oxidation in the presence of a bacterial and/or fungal supplement.

6 A process according to claim 5, wherein the supplement is added to the waste water at an initial dosage in the range of from 50 to 500 lbs per ton BOD.

7 A process according to claim 6, wherein the supplement is added to the waste water in the treatment tank periodically at a dosage of up to 100 lbs per ton BOD.

8 A process according to any one of claims 1 to 7, wherein the treatment tank has two parallel side walls and end walls which are substantially semi-circular in section and has a depth in the range of from 2 to 4 metres.

9 A process according to any one of claims 1 to 8, wherein the waste water is aerated by injecting air under pressure into the waste water in the treatment tank by means of one or more directional air guns.

10 A process according to claim 9, wherein air is injected into the waste water by means of from 2 to 14 air guns thereby causing the waste water to circulate in the treatment tank.

11 A process according to either claim 9 or claim 10, wherein one or more of the air guns is positioned at an angle with the horizontal in the range of from 30 to 75°.

12 A process substantially as hereinbefore described with reference to the accompanying figures.

Patents Act 1977 Examiner's report to the Comptroller under Section 17 (The Search report)	Application number GB 9300341.6
Relevant Technical Fields (i) UK Cl (Ed.M) C1C (ii) Int Cl (Ed.5) C02F	Search Examiner R HONEYWOOD
	Date of completion of Search 5·4·94
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii) ONLINE DATABASE - WPI	Documents considered relevant following a search in respect of Claims :- 1-12

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document

Category	Identity of document and relevant passages		Relevant to claim(s)
A	GB 2039873 A	(SYDLO INC)	1 at least
X	US 4603000	(FABCON INCORPORATED)	1 at least